

The developmental arc of massive virtual collaboration

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FLOSS Research at Syracuse

- General research questions:
 - What practices make some distributed work teams more effective than others?
 - What are the dynamics through which self-organizing distributed teams develop and work?





What is FLOSS?

- FLOSS = Free/Libre Open Source Software
- Software distributed under license that allows inspection, modification and redistribution of the source code
 - AKA free or libre software
 - “Free as in speech” vs. “free as in beer”
- Examples: Linux, Apache, gcc, sendmail, X-windows, GNOME, GAIM, OpenOffice, etc.
 - ...as well as many lesser-known projects
- Why FLOSS?
 - Free/libre open source software development has been surprisingly successful
 - Increasingly important mode of software development

The specific problem

- Why do people contribute to open communities (massive virtual collaboration)?
 - Programming, documentation, bug reports in open source software development
 - Content for blogs, rating systems & Wikipedia
- Helpful to design attractive systems or to estimate likely success of projects



Contribution

cvs: squirrelmail/squirrelmail/functions



Current directory: [\[cvs\]](#) / [squirrelmail](#) / [squirrelmail](#) / [functions](#)

Files shown: 37

| File | Rev. | Age | Author | Last log entry |
|--|----------------------|----------|----------|---|
| Attic/ [show contents] | | | | |
| decode/ | | | | |
| encode/ | | | | |
| htmlentities/ | | | | |
| abook_database.php | 1.30 | 2 months | jervfors | Replacing tabs with spaces, trimming white space at EOL and newline at EOF (PHP ... |
| abook_ldap_server.php | 1.30 | 3 days | tokul | adding limit_scope and filter support. Should close #1035454 and #539534 patches... |
| abook_local_file.php | 1.35 | 10 days | tokul | adding listing controls to file backend |
| addressbook.php | 1.74 | 3 days | tokul | missing extension problems are handled inside backend class. This makes sure tha... |
| arrays.php | 1.3 | 3 months | kink | Increment year in copyright notice. |

squirrelmail/squirrelmail/functions/abook_local_

Default branch: MAIN

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Sun Mar 20 10:06:45 2005 UTC (10 days, 14 hours ago) by *tokul*

Branch: [MAIN](#)

CVS Tags: [HEAD](#)

Changes since **1.34**: **+15 -1** lines

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```
adding listing controls to file backend
```

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Branch: [SM-1 4-STABLE](#)

Changes since **1.22.2.5**: **+2 -2** lines

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```
sanitized ldap search.  
added sq_setlocale() function  
added force_decode option to charset_decode()  
added verbose address book error messages and checked if global address  
book is writable before trying to open it rw.
```

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Quebec

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This article is about the province of Canada. For the similar historical entity, see [Province of Quebec \(1763-1791\)](#). For the city, see [Quebec City](#). For other uses, see [Quebec \(disambiguation\)](#) and [Québécois \(disambiguation\)](#).

Quebec (pronounced [kʰwə?bɛk] or [kʰə?bɛk]) or, in French, **Québec** (pronounced [kebɛk]),^[1] is a [Canadian province](#) in [Eastern Canada](#).

Affectionately known as *la belle province* ("the beautiful province"), Quebec is bordered to the west by the [province of Ontario](#), [James Bay](#) and [Hudson Bay](#). To the north are the [Hudson Strait](#) and [Ungava Bay](#), to the east the [Gulf of Saint Lawrence](#), the provinces of [New Brunswick](#) and [Newfoundland and Labrador](#), and to the south the [United States](#) (the states of [New York](#), [Vermont](#), [New Hampshire](#) and [Maine](#)). It also shares maritime borders with the Territory of [Nunavut](#) and the provinces of [Prince Edward Island](#) and [Nova Scotia](#).

Quebec is Canada's largest province by area and its second-largest [administrative division](#); only the territory of [Nunavut](#) is larger. It is the second most populated province, and most of its inhabitants live along or close to the banks of the [Saint Lawrence River](#). The central and north portion of the province is sparsely populated and inhabited by the [aboriginal peoples of Canada](#).

The [official language](#) of Quebec is [French](#); it is the sole Canadian province whose population is mainly [French Canadian](#), and where [English](#) is not an official language at the provincial level.

Quebec, then called [Canada](#), formed part of the colonial empire of

Québec Quebec^[1]



Flag



Coat of arms

Motto: *Je me souviens* (French: I remember)



Capital

[Quebec City](#)

Largest city

[Montreal](#)

Quebec

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- (cur) (last)  01:37, 1 August 2006 [70.81.13.229](#) ([Talk](#)) (*→The Parti Québécois and constitutional crisis*)
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Prior research on motivation in FLOSS

- Economic model: benefit > cost (Lerner & Tirole 2002)
 - Cost: opportunity cost of time
 - Benefits
 - Future job offers & ego gratification from peer recognition, taken together as signalling
 - The working code itself

EXHIBIT 16.4
Major elements of expectancy theory

Vroom 1965

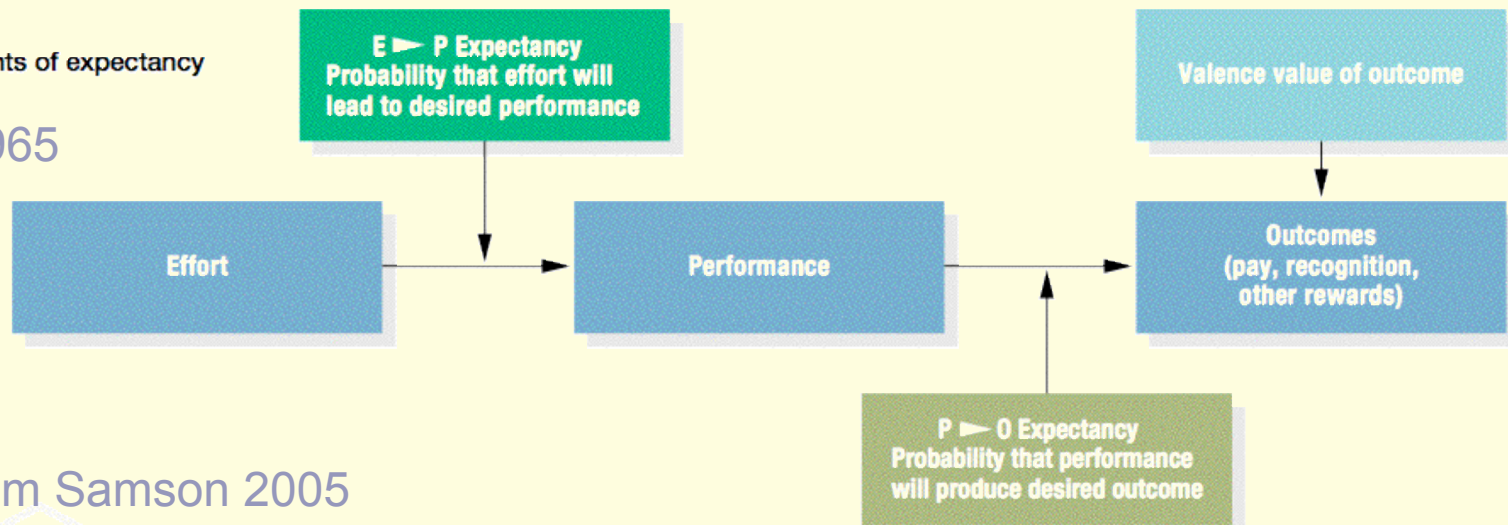
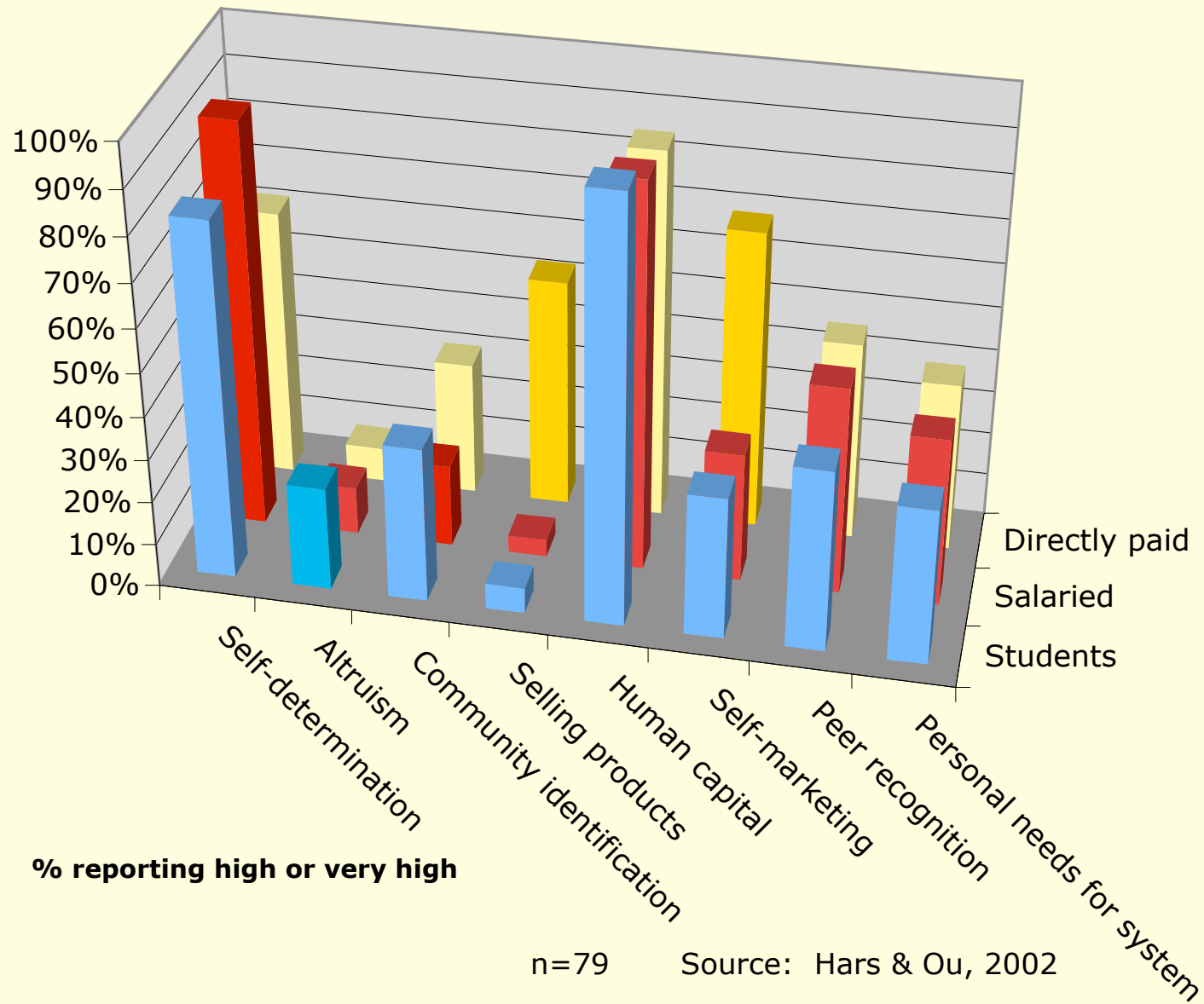
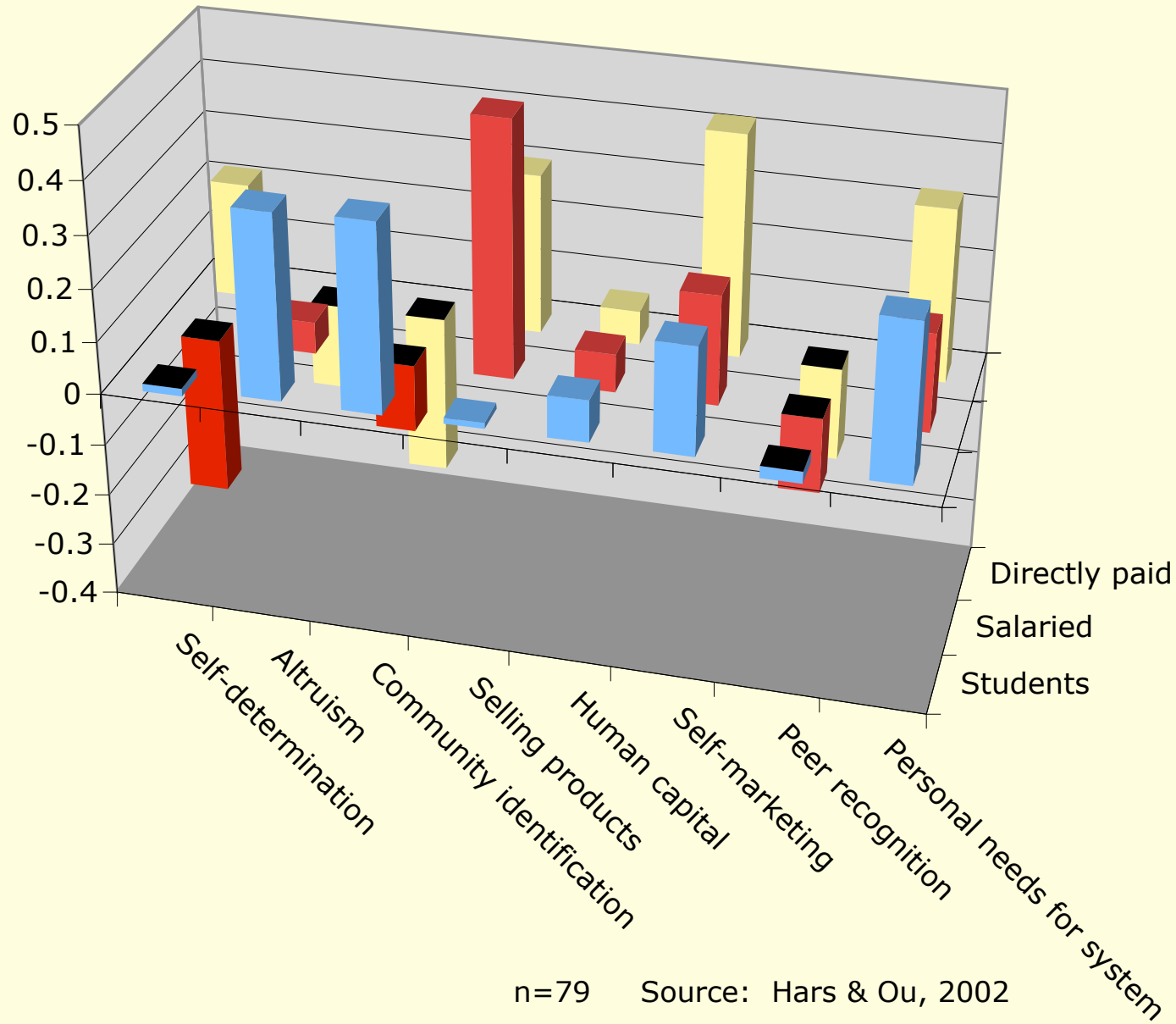



Figure from Samson 2005

Reported motivations for participation



Correlation of motivation with reported effort





Motivations in Wikipedia

- Some research (e.g., Kuznetsov 2006; Forte & Bruckman 2005)
- Suggested motivations:
 - Self-determination
 - Altruism
 - Community identification
 - Peer recognition
 - Reciprocity
- Not suggested:
 - Future rewards
 - Revenue from related services
 - Human capital
 - Self-promotion
 - Personal needs for system

squirrelmail/squirrelmail/functions/abook_local_

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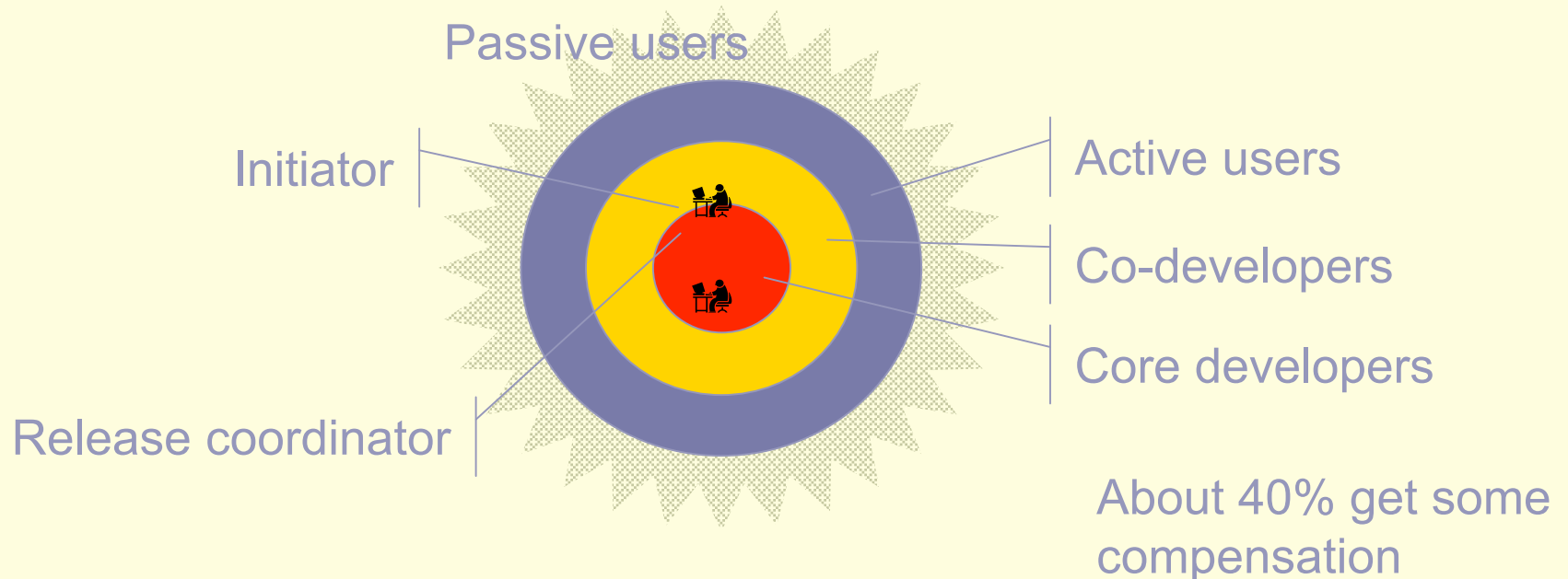
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Opportunities for a richer model

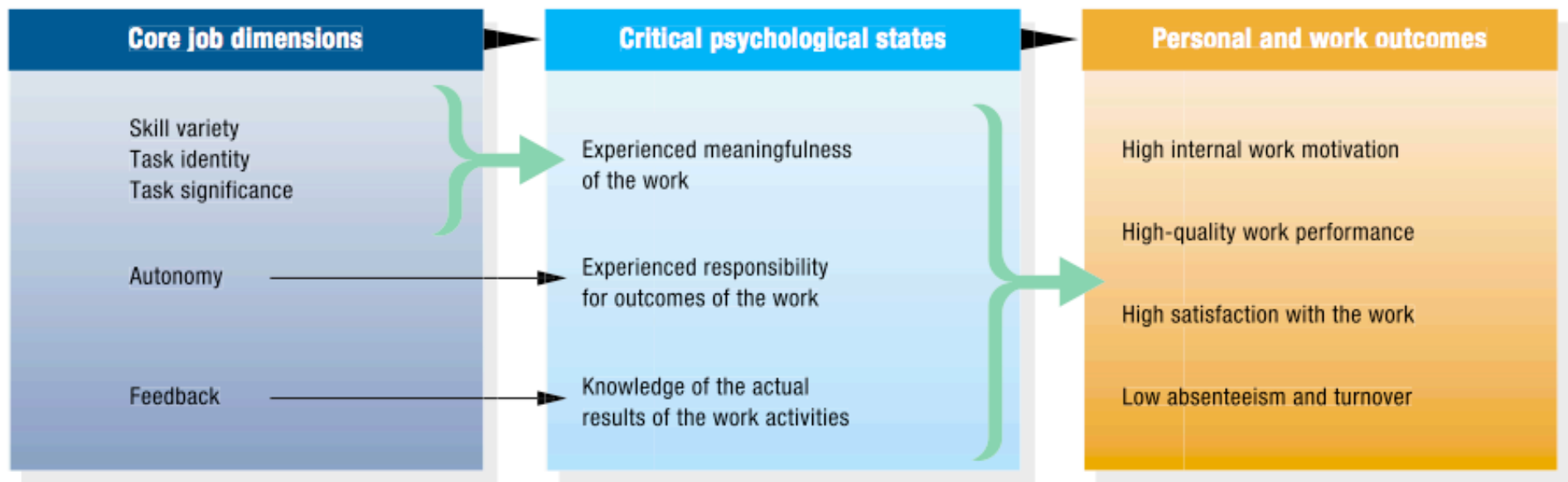
- Prior research doesn't consider differences in individual role in project...



- ...nor status of the project
 - Initial development, growing, mature

Further opportunities

- Theory can be informed by earlier research on motivation, e.g., Hackman & Oldham's model

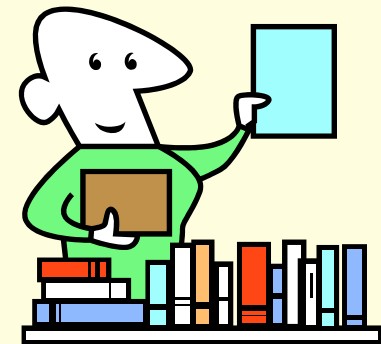


SOURCE: Adapted from J. Richard Hackman and G. R. Oldham, 'Motivation through the Design of Work: Test of a Theory', *Organizational Behavior and Human Performance*, 16, 1976, p. 256.

- Theory should be dynamic rather than static

Our model

- Individuals move through stages of participation
 - Motivations in different stages are different
 - A few advance to further stages
- Project similarly mature and different motivations may be active at different stages



Initial stage: Curiosity

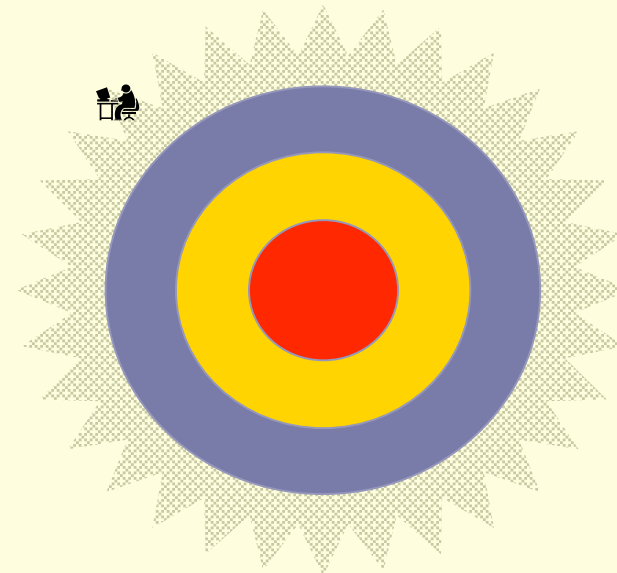


● Preconditions:

- Project is visible enough to attract attention (i.e., we're not analyzing project foundation)
- Individual is curious about project
- Time & expertise exceed expected cost to contribute

● Result

- Initial contribution
- Individual moves from passive to active user



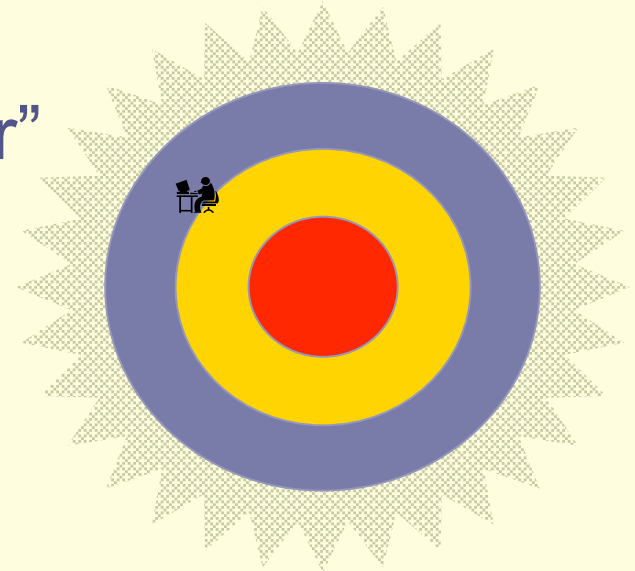



Data

- SourceForge reports 1,562,472 registered users
- Apache bug tracker has reports from 15,796 distinct IDs
- Wikipedia reports 4,150,427 accounts
 - * Both as of 4/17/07 1:31 PM

Second stage: Sustained contribution

- Individuals receive feedback on initial contribution
 - More positive for substantive contributions
- A few become sustained contributors
 - In early stages of a project, consider as “helping behaviour”
 - In later stages of a project, consider as joining a social movement





Four precursors to helping behaviours

(Schwartz & Howard, 1982)

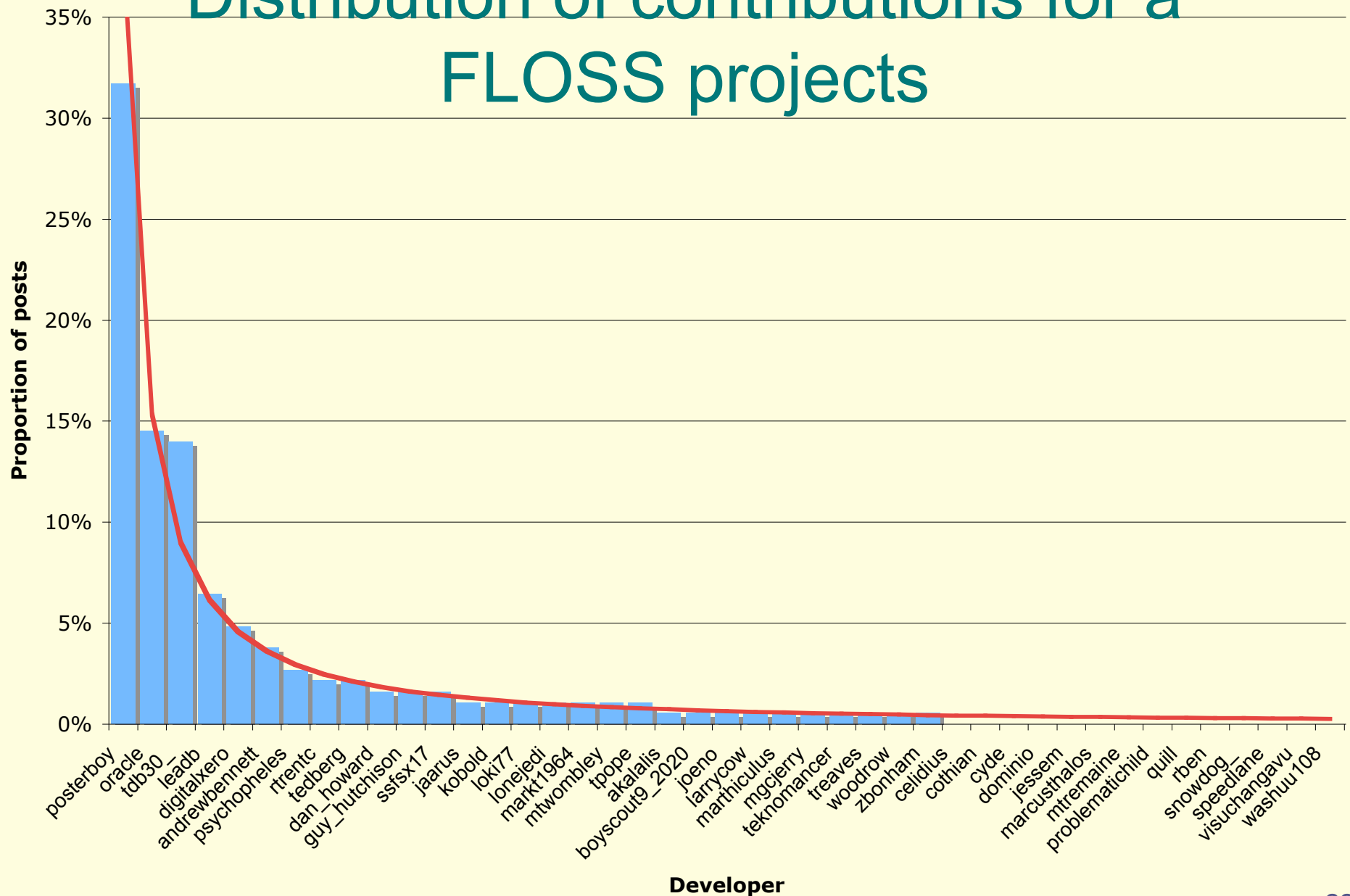
- Attention to need for help
 - Visibility
 - Personal interest
- Motivation to respond
 - Self-efficacy
 - Voluntaristic & helping nature
 - Group identification
 - Attraction-Selection-Attrition (Schneider et al. 1995)
- Positive evaluation of helping
- Lack of negative defence mechanisms



Four motivations for joining a social movement (Klandermans 1997)

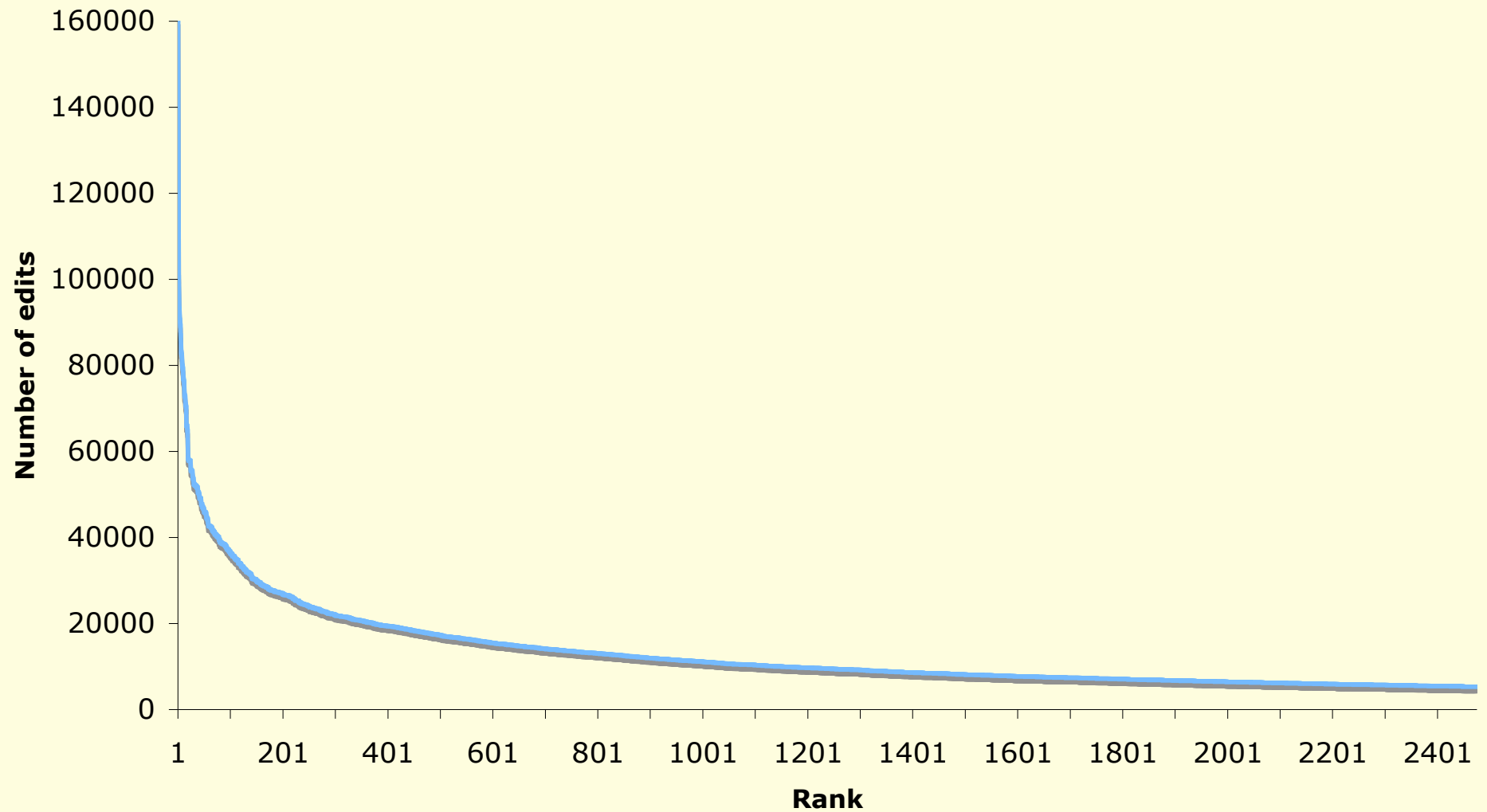
- Reward motives
 - Personal gains from membership
- Collective motives
 - Positive evaluation of group's goals or ideology
- Social motives
 - Social reinforcement from other members
- Identification with the group
 - Positive feeling of being part of the group

Distribution of contributions for a FLOSS projects





Distribution of number of Wikipedia edits by individual



Source: http://en.wikipedia.org/wiki/Wikipedia:List_of_Wikipedians_by_number_of_edits



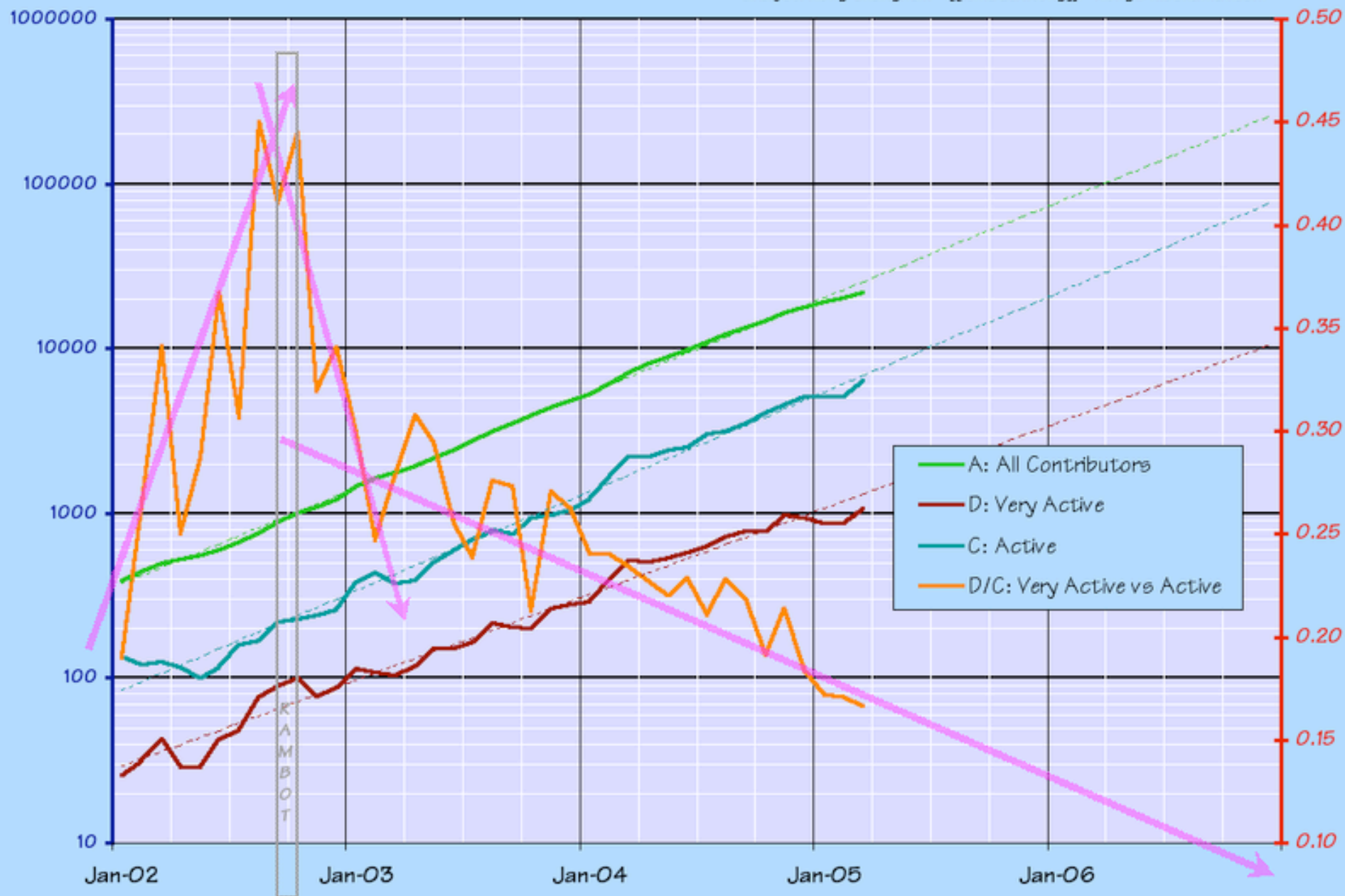


Numerically

- SourceForge has 171,599 members associated with projects (about 11%); 113,644 are admins (about 7%) (Source: <http://ossmole.sourceforge.net/>)
- Apache has 1562 committers (Source: <http://people.apache.org/~jim/committers.html>)
- Distribution of Wikipedia edits:
 - About 54% edited only once or twice
 - 25% edited 10 times or more
 - 5% edited 100 times or more
 - Top 2.4% of editors contributed 80% of the edits
 - Top 1% contributed 68.6%(Source: <http://stats.wikimedia.org/EN/TablesWikipediaEN.htm>)

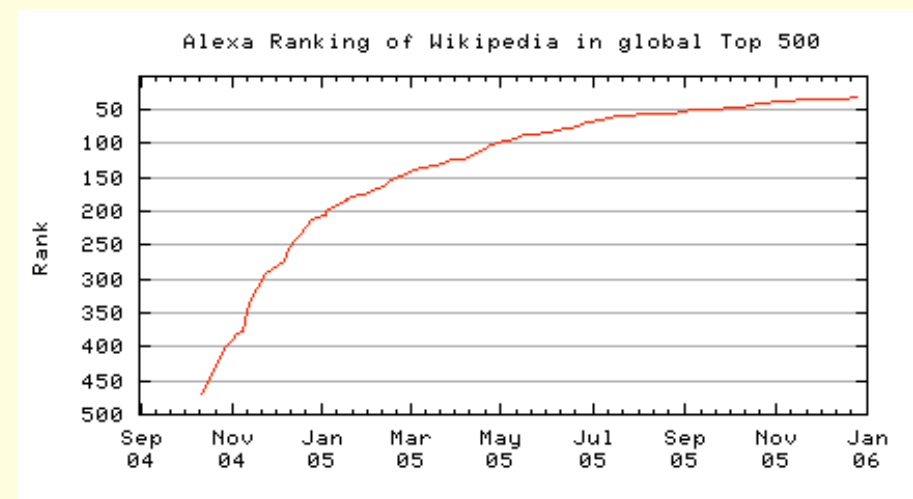
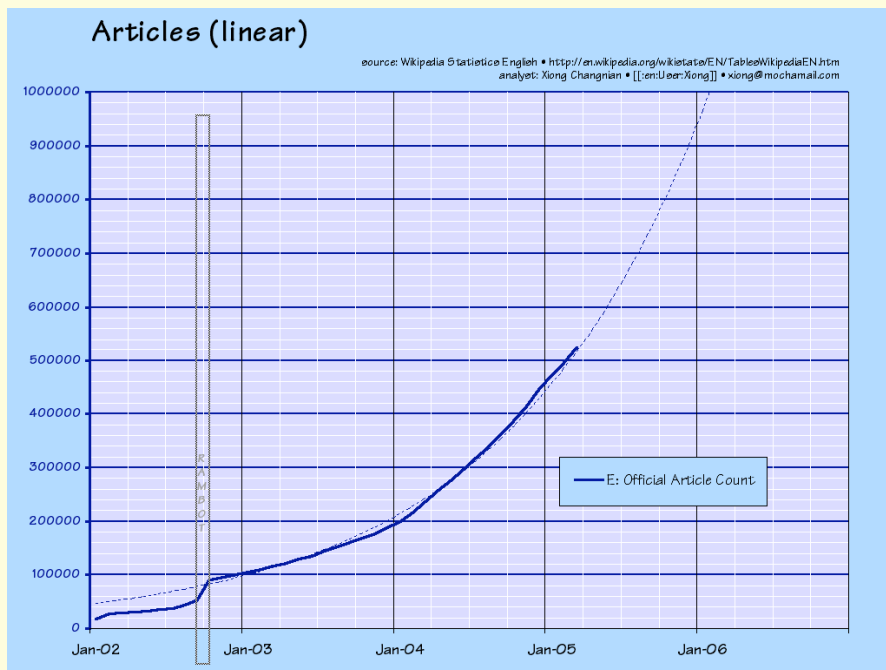
Wikipedians

source: Wikipedia Statistics English • <http://en.wikipedia.org/wiki/statistics/EN/Tables/WikipediaEN.htm>
analyst: Xiong Changnian • [\[\[\[:en:User:Xiong\]\]](#) • xiong@mochamail.com



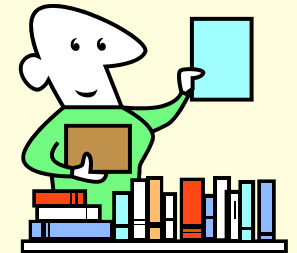
Feedback

- Feedback to previous stage
 - Sustained contributions increase visibility of project, thus attracting more initial contributions

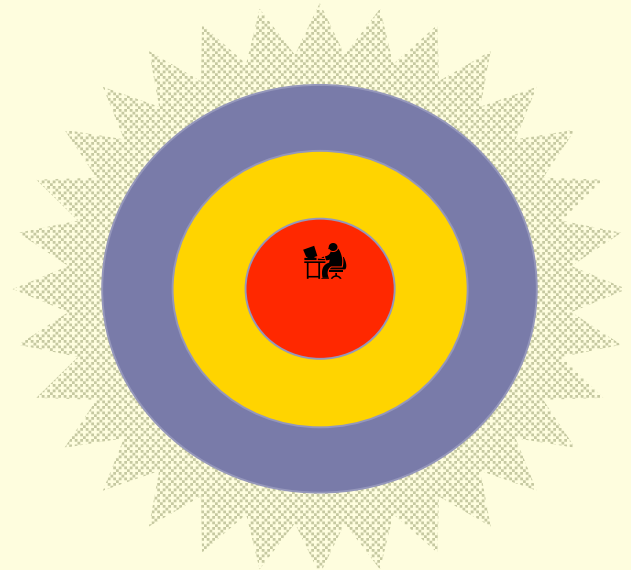


Source: Wikipedia

Third stage: Meta-contribution



- A very few become “meta-contributors”
 - Foundation members in open source
 - Maintainers, admins, sysops, bureaucrats or stewards in Wikipedia
- Seems to be based on:
 - Voluntaristic & helping nature
 - Group identification
- Feedback to previous stage:
 - Meta-contributions enable more basic contributions





Data

- Apache Foundation has 144 members (source: <http://www.apache.org/foundation/members.html>)
- Wikipedia has 1,177 administrator accounts (or 0.03%) (Source: <http://en.wikipedia.org/wiki/Special:Statistics>)



Practical implications

- Early stages
 - Make project visible
 - Reduce barriers to entry (e.g., more modular architectures)
 - Provide positive feedback for contributions
- Sustained contribution
 - Provide continual opportunities to contribute
 - Ensure tasks seem meaningful
 - Articulate shared values
- Meta-contribution
 - Reward sustained contribution with increased authority and visibility



Research implications

In studying MVC:

- Be sure to consider role of participants
- Consider stage of development of projects
- Focus studies on the 2.5% who do the work
- But don't overlook contributions of the long tail
- Separate contribution from meta-contribution
 - Meta-contribution may be linked to leadership



Future work

- Figure out why so few women take part
 - At what stage in the process do they select out?
- Study process of socialization that shapes group identification
- Study growth of projects for evidence of feedback
- Test limits of model
 - E.g., does this apply to massively multi-player games?